APPENDIX E
TERRAIN MORTAR POSITIONING

To increase survivability on the battlefield, a mortar platoon section must take advantage of the natural cover and concealment afforded by the terrain and existing vegetation. Each mortar is positioned to fit the folds and vegetation of terrain without regard to the bursting diameter of the mortar's ammunition. When mortars are positioned without regard to standard formations, firing corrections (M16/M19 plotting boards) are required to obtain a standard sheaf in the target area. These corrections compensate for the terrain positioning of the mortars (Figure E-1).

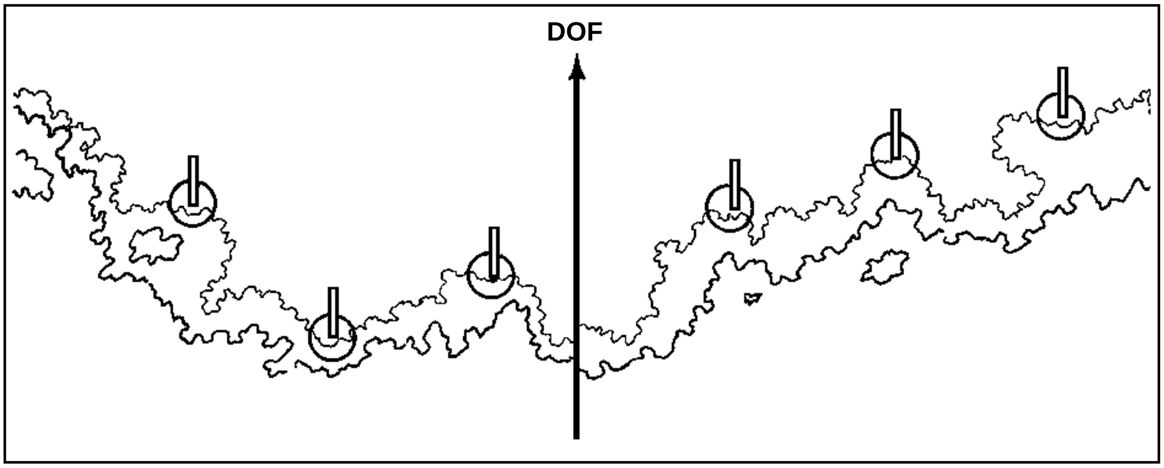

Figure E-1. Positioning of mortars with respect to terrain.

E-1. PIECE DISPLACEMENT

To determine the position corrections for each mortar, a platoon must know the relative position of the mortars in the area. Piece displacement is the number of meters the piece is forward or behind and right or left of platoon center. It is measured on a line parallel (forward or behind) and perpendicular (right or left) to the azimuth of lay (Figure E-2). Piece displacement can be determined by estimation, pacing, or hasty traverse.

a. Using the *estimation technique* (the least desirable), the platoon leader or section chief estimates the displacement about the platoon center perpendicular to the azimuth of lay.

b. The *pacing technique* provides accuracy in small open areas but is time consuming. The lateral distance from the base piece and the distance forward or behind the base piece to each mortar must be measured.

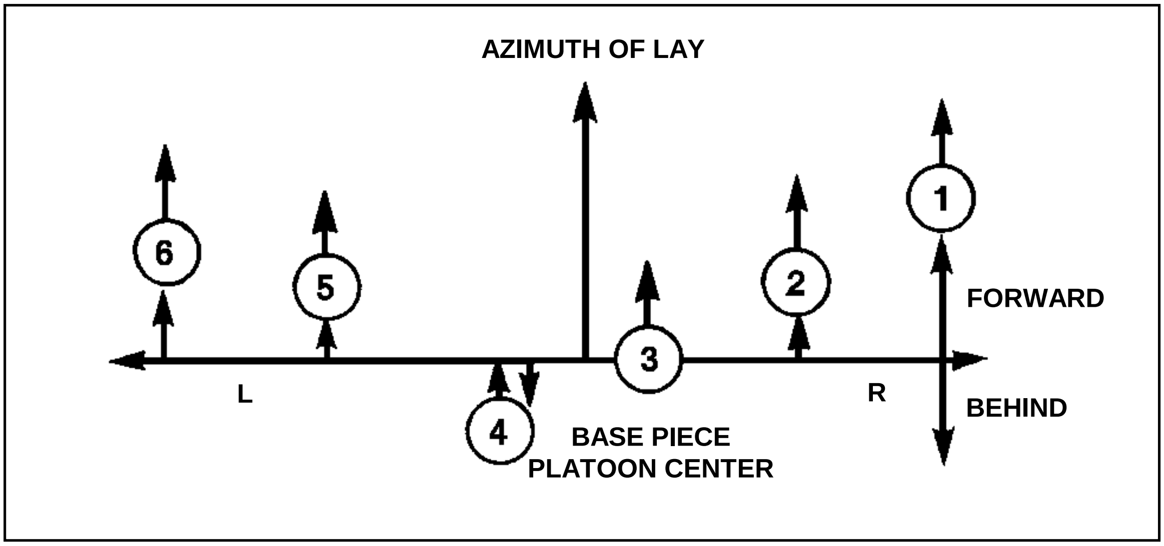

Figure E-2. Piece displacement relative to base piece.

c. The *hasty traverse technique* is the most accurate and rapid technique for determining piece displacement. The deflection and distance from each mortar to the aiming circle must be measured to plot their locations on the M16/M19 plotting board. These deflections are recorded and reported to the FDC. The distance from each mortar to the aiming circle can be determined by the following methods:

(1) In *straight-line pacing*, each squad has one man to pace the distance from the mortar to the aiming circle. The gunner can guide the man on a straight line by sighting through the mortar sight.

(2) When using a *subtense bar* for TMPC computations, a 2-meter rod is used. It is held parallel to the ground at the aiming circle location. Each gunner traverses his sight from one end to the other and records the number of mils traversed by the sight. This value is used to enter a subtense table (Table C-1, page C-10) to determine the number of meters between the mortar and the aiming circle. Distances up to 250 meters can be measured to within a fraction of a meter. (For details on the use of the subtense bar and the subtense table, refer to Appendix C.)

d. Once the deflection and distance values are known for each mortar, their locations can be plotted on the M16/M19 plotting board. The pivot point represents the location of the base piece. The location of the aiming circle is plotted in relation to the base piece. The other mortars are plotted in relation to the aiming circle.

E-2. M16/M19 PLOTTING BOARD

The computer uses the M16/M19 plotting for computing TMPCs. The grid base represents the target area. The small squares can be assigned any convenient value (10 meters is recommended). The arrow and center line on the base represent the direction of fire. The vernier scale is used to help determine azimuths and deflections.

a. To prepare the base for use in computing TMPCs, the computer draws a series of lines parallel to the center line representing the burst lines for each mortar. The center line, running through the pivot point, is the burst line for the base piece. The remaining burst lines are constructed left and right of the center line by letting each small square equal 10 meters and drawing the burst lines parallel to the center line. The distance between burst lines is equal to the bursting diameter of the mortar systems' HE ammunition. For the M224 mortar, the distance is 30 meters; for the M29A1 mortar, the distance is 35 meters; for the M252 and M30 mortars, the distance is 40 meters; and for the M120, the distance is 60 meters. A burst line is drawn for each mortar in the platoon or section (Figure E-3).

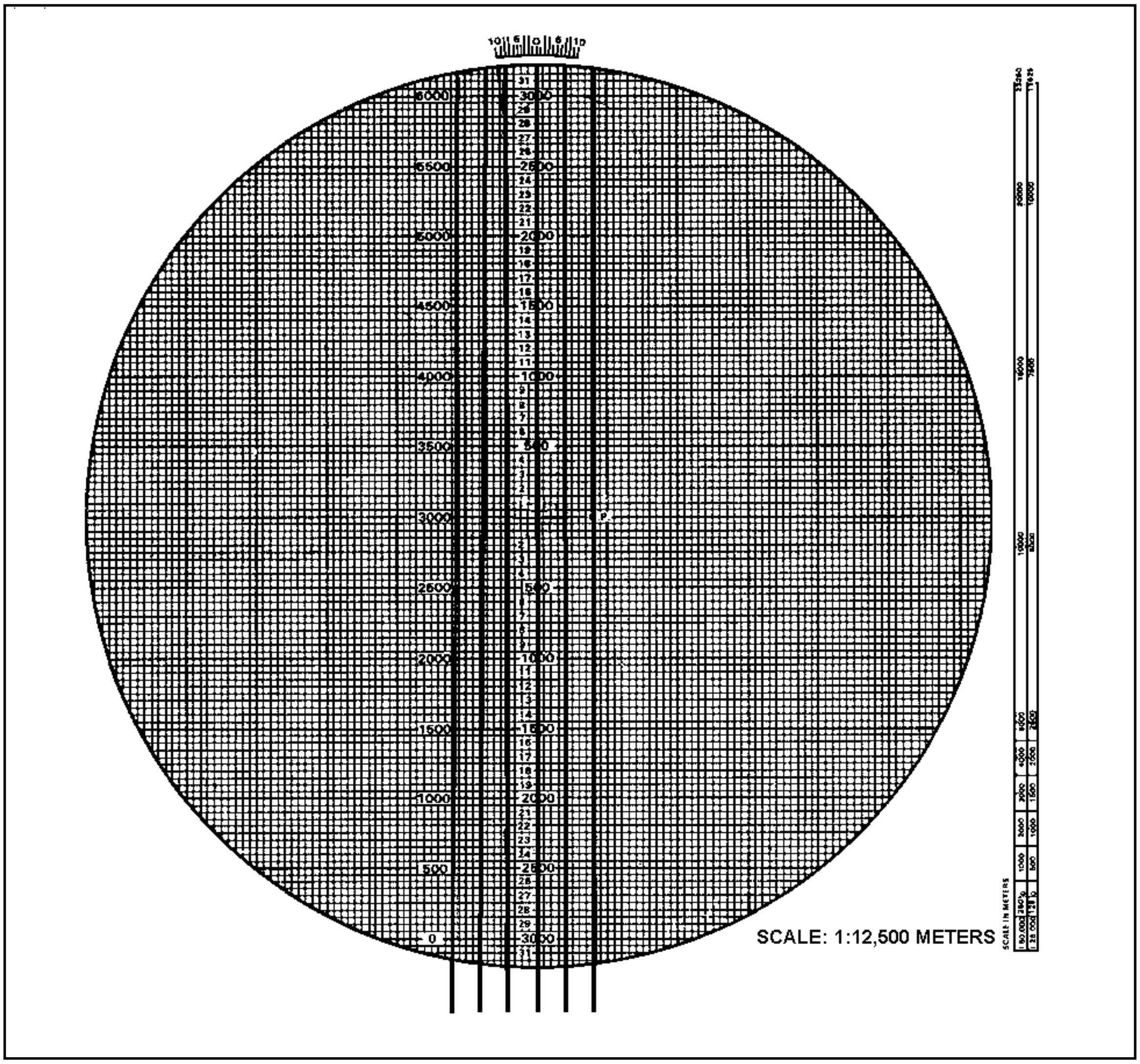

Figure E-3. Burst lines for a six-mortar 4.2-inch mortar platoon.

b. The clear rotating disk of the plotting board is used to plot the location of each mortar. The disk has an azimuth scale around the outside edge; a temporary lay deflection scale must be superimposed on the disk. The lay deflection scale increases from left to right as does the azimuth scale. Deflection 3200 always corresponds to the azimuth of lay when determining piece displacement (Figures E-4a to E-4d). Once superimposed, the lay deflection scale is used to plot the location of the aiming circle and the mortars.

EXAMPLE

Given: Azimuth of lay is 6400 mils.

The deflection and distances from the aiming circle to each mortar are:

Mortar	*Deflection (mils)*	*Distance (meters)*
No. 1	800	200
No. 2	1900	135
No. 3 (Base Piece)	2400	95 (Figure E-4a)
No. 4	2950	120
No. 5	3400	140
No. 6	3950	115

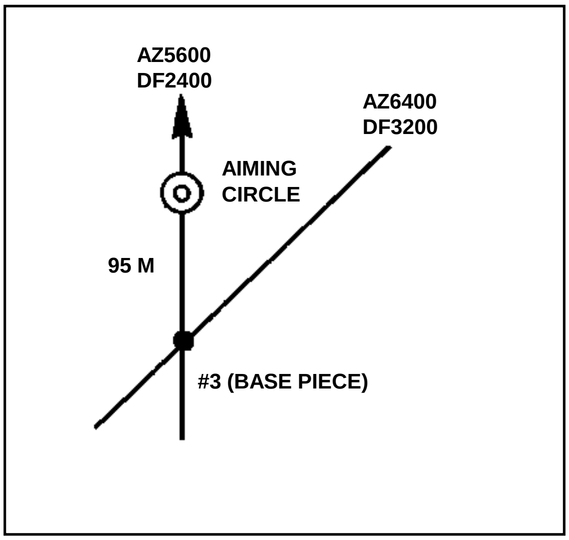

Figure E-4a. Determination of piece displacement.

Step 1. Index the lay deflection from the aiming circle to No. 1 (1800 mils over the center line arrow).

Step 2. Count off 200 meters parallel to the center line down from the aiming circle. Place a circled dot there and label it No. 1.

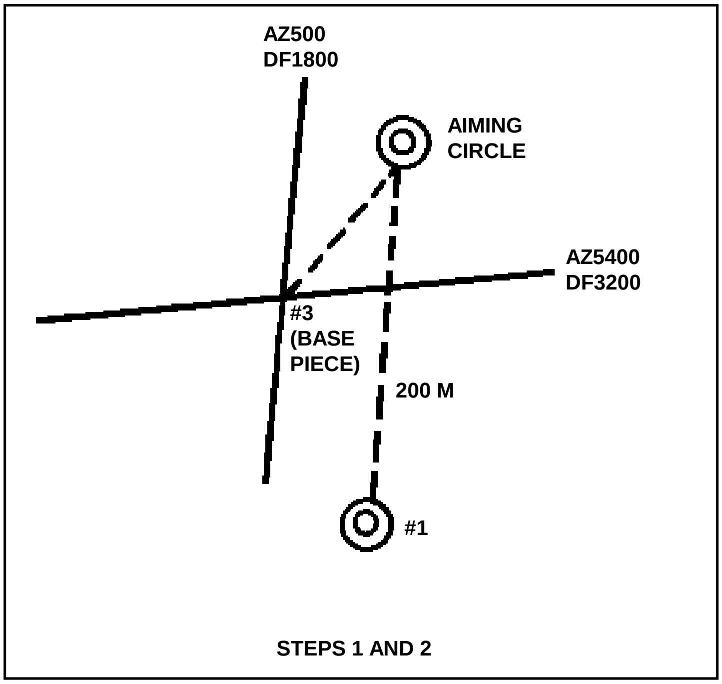

Figure E-4b. Determination of piece displacement (continued).

Step 3. Index the lay deflection from the aiming circle to No. 2 (1900 mils over the center line arrow).

Step 4. Count off 135 meters parallel to the center line down from the aiming circle. Place a circled dot there and label it No. 2.

Step 5. Index the lay deflection from the aiming circle to the No. 4 (2950 mils over the center line arrow).

Step 6. Count off 120 meters parallel to the center line down from the aiming circle. Place a circled dot there and label it No. 4.

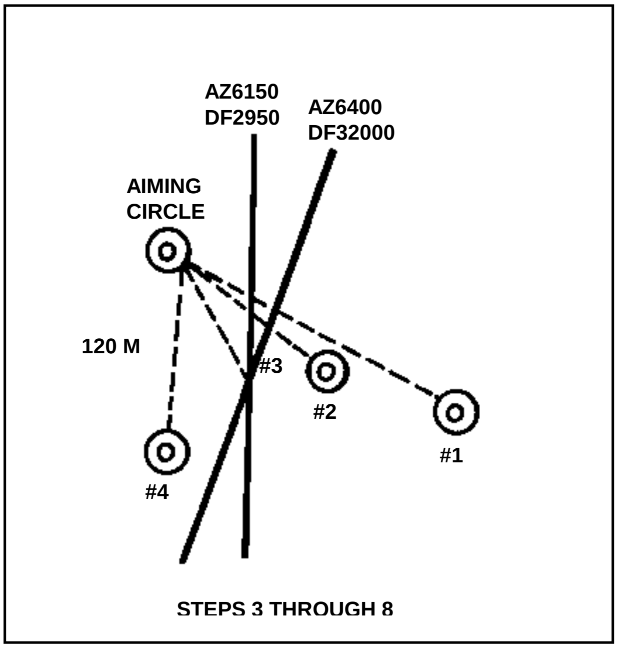

Figure E-4c. Determination of piece displacement (continued).

Step 7. Follow the same procedures to plot No. 5 and No. 6.

NOTE: Once all mortar locations are plotted, erase the temporary lay deflection scale and superimpose a referred deflection scale as performed when setting up the M16/M19 plotting board. For example, if the referred deflection is 2800, the referred deflection scale is superimposed on the disk beginning with 2800 corresponding with the azimuth of lay. The deflection increases to the left and decreases to the right.

Step 8. Index the azimuth of lay (6400 mils over the center line arrow) and read the displacement of each mortar right/left and forward/behind the base piece.

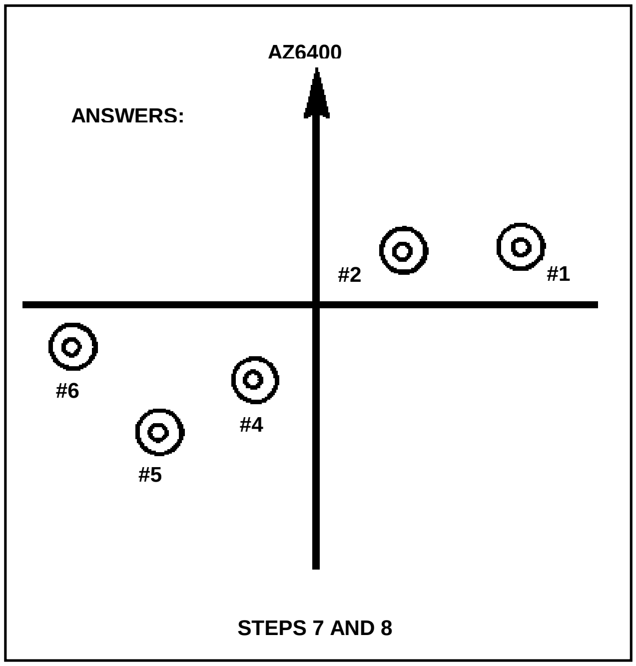

Figure E-4d. Determination of piece displacement (continued).

ANSWERS

Mortar	**Displacement**	
No. 1	130R,	30F
No. 2	60R,	30F
No. 3 (Base Piece)	—	—
No. 4	40R,	45B
No. 5	95L,	70B
No. 6	145L,	15B

(**R** —right; **L**—left; **F**—forward; **B**—behind)

c. TMPCs are computed before occupation of a position by the mortars when possible, but they can be computed after occupation. They are applied to each mortar's firing data to achieve standard sheafs in the target area. The TMPCs are computed and applied whenever the mortar platoon occupies a position that is wider than the width of the mortar system's sheaf or deeper than the bursting diameter of its HE ammunition.

d. The TMPCs are most accurate at the range and direction for which they were computed. They are considered valid 2,000 meters over and short of the center range and 200 mils left and right of the center azimuth of the sector (Figure E-5).

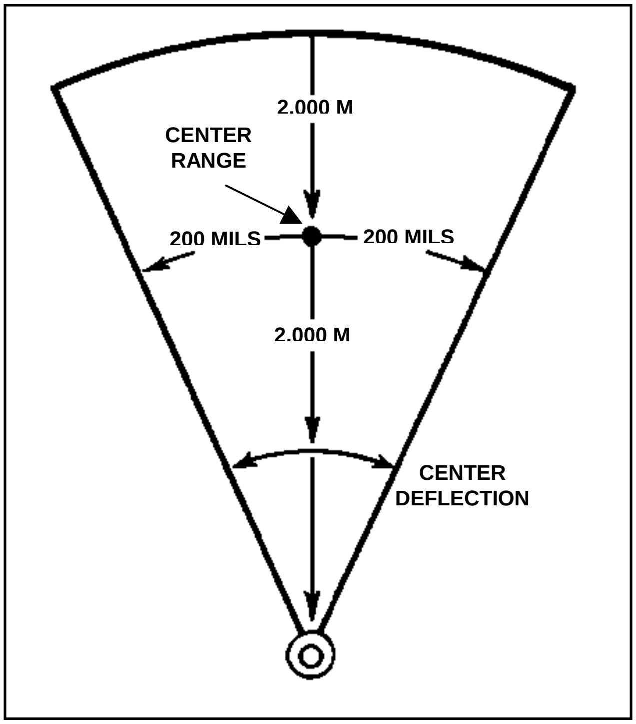

Figure E-5. Transfer limits of TMPCs.

(1) The TMPCs provide acceptable sheafs on targets as long as the platoon position is within the dimension parameters below:

- Six guns—400 meters wide by 200 meters deep.
- Four guns—250 meters wide by 200 meters deep.
- Three guns—200 meters wide by 100 meters deep.
- Two guns—100 meters wide by 100 meters deep.

(2) The box formed by the dimension parameters is centered over the platoon and oriented perpendicular to the azimuth of lay. If the platoon is spread out more than indicated dimensions, a degradation in the effectiveness of sheafs can be expected as fires are shifted throughout the sector away from the center range and deflection (Figure E-6).

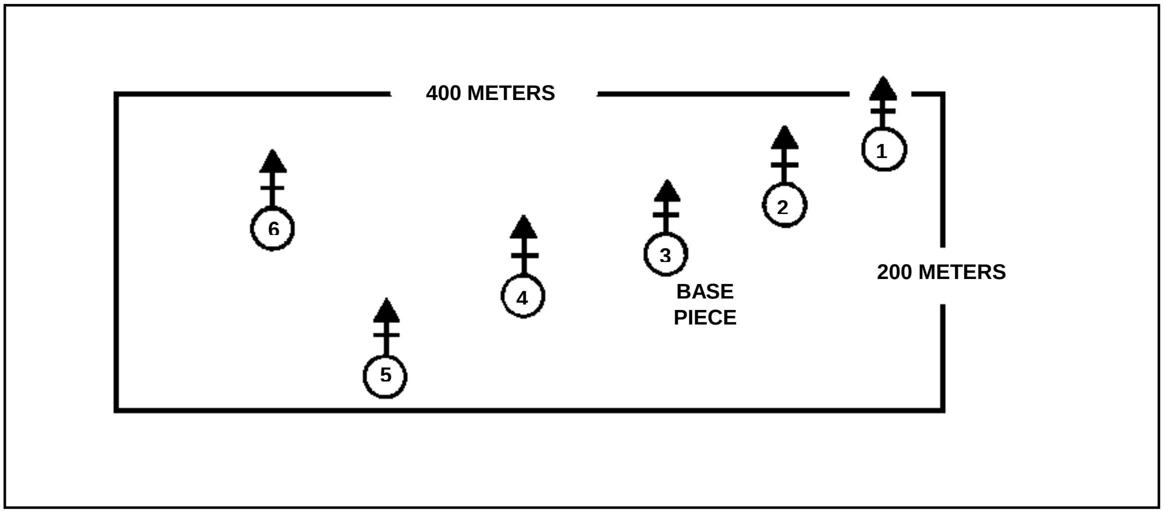

Figure E-6. Dimension parameters for six-mortar platoon.

(3) Since a mortar unit's area of responsibility covers an area larger than the TMPC limits, TMPCs should be computed for three sectors: primary, left, and right. Sectors can also be computed for shorter or longer ranges to provide valid corrections throughout the mortar systems available range.

(4) When using TMPCs, the platoon leader must establish an SOP directing that primary TMPC sector data are used unless otherwise indicated. If other than the primary sector is to be used, it is indicated in the corrections to apply in the FDC order or immediately following the announcement of MORTAR TO FOLLOW in the initial fire command:

EXAMPLE

SECTION, LEFT SECTOR, HIGH-EXPLOSIVE
PROXIMITY, DEFLECTION.................…........

NOTE: The absence of any instruction concerning TMPCs in the initial fire command indicates that corrections for the primary sector will be fired. The command, CANCEL TERRAIN CORRECTIONS indicates that no TMPCs are to be used for that mission.

E-3. DETERMINATION OF TMPCs

Before the TMPC can be computed, the piece displacement for each mortar must be plotted on the M16/M19 plotting board from a hasty traverse, when possible.

a. If it is not and piece displacement relative to the azimuth of lay is known, the following method is used to plot the weapons on the plotting board:

(1) Index the azimuth of lay on the plotting board.

(2) Plot the mortars right/left and forward/behind the platoon center (base piece).

(3) After piece displacement (for a given azimuth of lay) has been determined and plotted, compute corrections for a TMPC sector on the terrain mortar position or special correction worksheet.

NOTE: The TMPC worksheet can also be used to compute individual gun corrections for special missions such as attitude missions.

(4) TMPC computations are performed in a step-by-step format as indicated on the worksheet. The data required for the computations are as follows:

- Piece displacement
- Center range and deflection to sector.
- Charge (60/81/120 mm) or elevation (4.2-inch) to center range.

(5) An example of a computation of TMPCs using DA Form 5424-R is as follows (Figure E-7):

(a) A six-gun mortar platoon firing from the same location is laid on an azimuth of 6400 mils.

(b) Referred deflection is 2800 mils.

(c) Center range is 4,500 meters.

(d) The information below is provided to the FDC:

Mortar	**Displacement Relative to Azimuth of Lay**	
No. 1	130R	30F
No. 2	60R	30F
No. 3 (Base Piece)	—	—
No. 4	40L	45B
No. 5	95L	70B
No. 6	145L,	15B

(**R** —right; **L**—left; **F**—forward; **B**—behind)

(e) The transfer limits block is computed as follows:

- Circle the sector for which the corrections are to be computed, primary (P).
- Record the charge (60/81/120-mm) or the elevation (4.2-inch) used to achieve the center range (for reference purposes only).
- Record the referred deflection to the center (C) (2800), left (L) (3000), and right (R) (2600) limits of the sector.
- Record the minimum (2500), center (4500), and maximum (6500) ranges for the sector.

TERRAIN MORTAR POSITION/SPECIAL CORRECTIONS WORKSHEET

SECTOR: LEFT, PRIMARY, RIGHT		TRANSFER LIMITS LEFT	CENTER	RIGHT		CHARGE OR ELEVATION 0800
CENTER DEFLECTION + 200m	DF	3000	2800	2600	DF	CENTER DEFLECTION - 200m
CENTER RANGE + 2000M	RG	2500 (MAXIMUM)	4500	6500 (MINIMUM)	RG	CENTER RANGE - 2000M

1 MORTAR NO.	2 CORRECT TO BURST LINE NO.	3 POSITION LATERAL CORRECTION (L or R)	4 100/R (MIL CONVERSION TABLE) ~ CENTER RANGE	5 POSITION DEFLECTION CORRECTION (3) x (4) / 100 (L or R)	6 POSITION RANGE CORRECTION (F = -) (B = +)	7 CORRECTED RANGE (6) ≈ 10M PLUS CENTER RANGE	8 FUZE SETTING ~ (7)	9 POSITION TIME CORRECTION (8) MINUS FS ~ CENTER RANGE
		≈ 5M	≈ 1m	≈ 1m	≈ 10M	≈ 10M	0.1, FSI	0.1, FSI
1	1	L50	23	L12	-30	4470	32.5	-0.1
2	2	L20	23	L5	-30	4470	32.5	-0.1
3	3	0	23	0	0	4500	32.6	—
4	4	0	23	0	+40	4540	32.8	+0.2
5	5	R15	23	R3	+70	4570	32.9	+0.3
6	6	R25	23	R6	+20	4520	32.7	+0.1

LEGEND:
100/R - Number of mils required to move the strike of the round 100 meters for a specified range.
F - Forward.
B - Behind or Back.
0.1, FSI - Fuze Setting Increment.
~ - Corresponding To.
≈ - To The Nearest.

DA Form 5424-R, May 85

Figure E-7. Example of completed DA Form 5424-R.

NOTE: See FM 7-90 for a blank reproducible copy of DA Form 5424-R.

b. Determination of TMPCs for the center sector includes the following:

(1) Index the center of sector deflections on the M16/M19 plotting board.

(2) Determine the burst line to which each mortar corrects. Record this in the correct to burst line number (block 2). When determining the proper burst line for each mortar, start with the far right mortar, in relation to the direction of fire, and correct it to the far right mortar to the second burst line. Continue by correcting the second far right mortar to the second burst line from the right. Each mortar is corrected to the nearest burst line that has not been used by another mortar.

c. Record the position lateral correction required to move each mortar to its selected burst line in column 3 to the nearest 5 meters. Record the required position range correction (the number of meters forward or behind platoon center) in column 6 to the nearest 10 meters. If the mortar is forward of platoon center, the correction is a minus; if it is behind platoon center, the correction is a plus.

d. Using the mil conversion table (deflection conversion table) (Table E-1), determine the 100/R value at the center range for the sector and record it in block 4. The largest 100/R value used is 40; therefore, if 100/R is actually larger than 40, enter in block 4. Now, perform the computation shown in the heading of block 5. Label the corrections L (for left) or R (for right). The sign used in block 3 always carries to block 5. Express and record the value to the nearest mil.

RANGE	100/R	RANGE	100/R
1000	102	4100	25
1100	92	4200	24
1200	85	4300	24
1300	73	4400	23
1400	73	4500	23
1500	68	4600	23
1600	64	4700	22
1700	60	4800	22
1800	57	4900	21
1900	54	5000	21
2000	51	5100	21
2100	48	5200	20
2200	46	5300	10
2300	44	5400	19
2400	42	5500	19
2500	41	5600	19
2600	39	5700	19
2700	38	5800	18
2800	36	5900	18
2900	35	6000	18
3000	34	6100	17
3100	33	6200	17
3200	32	6300	17
3300	31	6400	17
3400	30	6500	16
3500	29	6600	16
3600	28	6700	16
3700	28	6800	16
3800	27	6900	15
3900	26	7000	15
4000	26	—	—

Table E-1. Mil (deflection) conversion.

e. In column 7, add the position range correction to the center range to obtain the corrected range. This value is used to compute the position time correction in column 9.

f. Enter the tabular firing table at the corrected range and extract the fuze setting. Record this value in column 8. Subtract the fuze setting corresponding to the center range from the value in column 8 and record the difference in column 9.

g. The values in columns 5, 6, and 9 are either sent to the guns and applied by the squad leader to the command data for each mission fired, or the FDC computes and applies the data, and it sends the corrected command data to each mortar for each mission.

E-4. APPLICATION OF TMPCs TO FIRING DATA

The position deflection correction is simply added to the deflection by the squad leader if the correction is left or subtracted if the correction is right. The position time correction for fuze M564 (4.2-inch) is added to the command fuze setting by the squad leader to obtain his fuze setting to fire.

a. To apply the position range correction, the squad leader must have a tabular firing table (TFT). He enters the TFT at the charge and elevation issued by the FDC and extracts the corresponding command range. He then adds his position range correction to the command range to determine his range to fire. He then reenters the TFT at the range to fire and extracts the charge to fire if he is a 4.2-inch squad leader or the elevation to fire if he is a 60/81/120-mm squad leader. Since the command data issued by the FDC include any corrections for vertical interval, when the position range correction is applied to the command range, corrections for vertical interval are already included.

EXAMPLE

A 4.2-inch mortar platoon is engaging a target at a range of 5,000 meters and a deflection of 2950. (The target is within the transfer limits of the primary TMPC sector.) The FDC issues the initial fire command: PLATOON, HE QUICK, NUMBER TWO GUN, TWO ROUNDS FUZE TIME, DEFLECTION TWO NINE FIVE ZERO (2950), CHARGE 35 3/8, TIME 34.7, ELEVATION ZERO EIGHT ZERO ZERO (0800).

b. Applying TMPCs for the No. 2 mortar, the squad leader adds 4 mils to the command deflection 2950 to determine his deflection to fire (2954). To determine his charge to fire, he enters the TFT at elevation 0800 with extension and charge 35 3/8. He extracts the corresponding command range (5000) for that charge and adds his position range correction (-30) to determine his range to fire (4970). He then reenters the TFT at the range to fire and extracts the corresponding charge to fire (35 1/8). To determine his time setting to fire, the squad leader adds his position time correction (-0.1) to the command time setting (34.7) and fires a time setting of 34.6.

c. Coupled with a registration, TMPCs eliminate the need to adjust the sheaf, thereby saving ammunition and decreasing the chances of detection by enemy countermortar radar.

d. Determining TMPCs for left and right sectors is accomplished with the same procedure using the center deflection to each of the sectors. The same applies to computing TMPCs for ranges that are outside the original TMPC sectors.

NOTE: The procedures are the same for the 60/81/120-mm mortars with the exceptions mentioned.

E-5. HASTY TERRAIN POSITIONS

When the advance party cannot conduct a reconnaissance of a mortar position due to time constraints or conduct hasty occupation of a hip-shoot position, TMPCs cannot be computed before occupation of the position by the mortar crews. Therefore, a modified technique of terrain mortar positioning can be used that still allows near maximum use of the terrain to provide cover and concealment for the platoon while placing acceptable sheaves on target (Figure E-8).

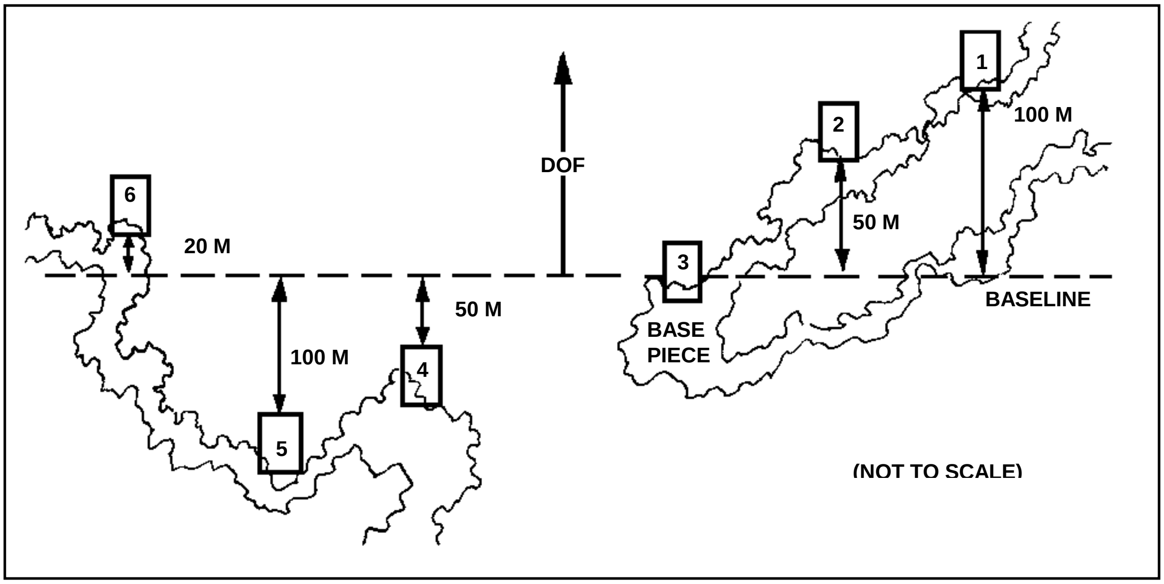

Figure E-8. Hasty positioning with respect to terrain.

a. To use the modified technique, the platoon occupies the position, conforming to the folds and tree lines of the terrain. It maintains a lateral dispersion between mortars equal to the bursting diameter of an HE round.

b. An imaginary line (base line) is drawn through the base piece perpendicular to the direction of fire (azimuth of lay). From this line, the squad leader determines the distance to his mortar. Mortars, other than the base piece, will either be on line with, forward of, or behind the basepiece. The distance from the base line can be measured by a squad member while the mortar is being laid or estimated by the squad leader. This distance is referred to as the position range correction and is recorded for future use by the squad leader. This position range correction is also given to the FDC for future use in computing TMPCs for the left and right sectors of fire. This position range correction is applied to the command data and issued by the FDC for a fire mission in the same manner as described in applying normal TMPCs.

c. The modified terrain mortar positioning technique establishes TMPCs for the primary sector and allows the platoon to rapidly engage targets, upon occupation of the position, up to 200 mils left or right of the azimuth of lay and achieve an acceptable sheaf on target. As soon as time allows, the FDC must compute TMPCs for the left and right sectors using the same procedures described in computing normal TMPCs to achieve acceptable sheaves on targets in those sectors.

d. There are no position deflection corrections for the primary sector. There will be position deflection corrections for the left and right sectors. Position time corrections should be computed as quickly as possible for the primary sector if fuze M564 is to be used.